CARNIVOROUS PLANT NEWSLETTER

Journal of the International Carnivorous Plant Society

Volume 27, No. 4 December 1998

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Official Journal of the International Carnivorous Plant Society
www.carnivorousplants.org

Volume 27, Number 4
December 1998

Front Cover: *S. flava* var. *rugelii*, see artiele on page 116.

Back Cover: *P. emarginata,* see article on page 121. Photo by Ron Parsons.

Carnivorous Plant Newsletter is dedicated to spreading knowledge and news related to carnivorous plants. Reader contributions are essential for this mission to be successful. Do not hesitate to contact the editors with information about your plants, conservation projects, field trips, or noteworthy events. Contributors should review the "Instructions to Authors" printed in the March issue of each year. Advertisers should contact the editors.

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Membership Coordinator	ICPS, 3310 East Yorba Linda Blvd. #330, Fullerton CA 92831-1709 USA
President	Rick Walker, phone: (650) 856-2354, email: rick@carnivorousplants.org
Vice President	Jay Lechtman, phone: (703) 707-5825, email: jay@carnivorousplants.org
Seed Bank & Back Issues	Tom Johnson, P.O. Box 12281,Glendale, CA 91224-0981 email: tom@carnivorousplants.org, http://www.primenet.com/~tjjohns/seed.htm

Editors:
Barry A. Meyers-Rice: P.O. Box 72741, Davis, CA 95617, USA (barry@carnivorousplants.org)
Jan Schlauer: Zwischenstr. 11, D-60594 Frankfurt, Germany (jan@carnivorousplants.org)
Page Layout:
Steve Baker: steve@carnivorousplants.org

Business Manager: Leo C. Song, Jr., phone: (714) 278-2766 (leo@carnivorousplants.org)

Date of effective publication of the September 1998 issue of Carnivorous Plant Newsletter: 9 September 1998. Accredited with the International Association for Plant Taxonomy for the purpose of registration of new names of vascular plants (excluding fossils).

The ICPS is the International Registration Authority (IRA) for cultivated carnivorous plants according to The International Code For The Nomenclature of Cultivated Plants. Send relevant correspondence to the ICPS, Inc.

PUBLISHER: ICPS, Inc., Fullerton, California. Published quarterly with one volume annually. Desktop Publishing: Steve Baker, 5612 Creek Point Drive, Hickory, NC 28601. Printer: Kandid Litho. Masthead Art: Paul Milauskas. Dues: $20.00 annually. $25.00 foreign. Reprints available by volume only

ISSN #0190-9215. Circulation 866 yearly.

Letter From The Editor: More Changes

Barry Meyers-Rice

I am excited to announce that the International Carnivorous Plant Society has ventured onto the world wide web with our own domain name! To see what is on the site already, direct your web browser to

http://www.carnivorousplants.org

and look around. At the time of this writing I have posted information about the Society and how to join, news items, instructions for submitting articles to Carnivorous Plant Newsletter, and links to related web sites. The site has generated so many new members that the costs of maintaining it have already been paid for. If you have any suggestions for things we should include there, please tell me! Incidentally, the three letters at the end of our web site, "org," reflect our approaching status of being a nonprofit organization. There is a website with the name www.carnivorousplants.com (Note "com" instead of "org") which is a different site owned by carnivorous plant enthusiast Jeff Gold. Do not worry if you do not have access to the world wide web—the web site will never be a replacement for Carnivorous Plant Newsletter.

Cultivars are being mentioned more frequently in Carnivorous Plant Newsletter. A cultivar name is a designation given to a plant that is of interest to horticulturists, but is not significant to taxonomists. Unfortunately, we carnivorous plant growers have not been very good about registering our cultivar names! To fix this problem, I have been recruiting plant growers to write cultivar articles on plants we already grow with not-yet established cultivar names. We are working on plants such as various *Drosera capensis* strains (red-blushed, or wide- and narrow-leafed forms), interesting *Sarracenia* varieties (such as giant forms or uncommon flower-color sports), and some *Utricularia*. If you are interested in establishing a cultivar name for us and have some plant in mind, contact me and I will tell you if someone else is already working on it. I can also give you some pointers on how to proceed. I am most interested in having descriptions named for tried-and-true plants that are popular with horticulturists. Time to get to work!

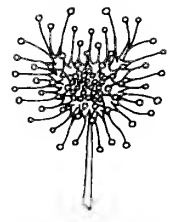
Finally, you may be wondering about the results of the ICPS election and logo contest. Since the Newsletter has advanced its printing schedule (did you notice you received your September and December issues on time?) the election and logo contests results were not ready in time for this issue. So you will have to wait for the March issue to find out the news...unless of course, you visit the web site!

Looking Back: CPN 25 years ago

Jim Forrest wrote about volcanism extirpating *Utricularia* in New Zealand: "There used to be six species of *Utricularia* in our locality but one species was destroyed in the eruption of Mt. Tarawera in 1886. During three hours, the volcano opened a chasm nine miles long as a tear. Towards the end it opened under Lake Rotamahaua and a tremendous explosion took place wiping out the famous pink and white terraces, the lake, and all plants in it. The whole countryside for some distance was showered with mud and rainstorms soon after, producing gutters in the mud which can be seen today. The *Utricularia* that was lost in this explosion was *U. mairii*, and to the best of my knowledge it has never been found there or in any other lake since." (Fans of *Utricularia* need not lament: "*U. mairii*" is an invalid name for *U. australis* which is still alive in many places!)

The Savage Garden

Peter D'Amato
California Carnivores
7020 Trenton-Healdsburg Road
Forestville, CA 95436



Keywords: cultivation: fertilizers, planting media.

Coco Peat Update

In the June issue of this year I wrote about coco peat as a possible substitute for *Sphagnum* peat in the soil recipes for carnivorous plants. Earlier this year I potted up a Venus Flytrap, *Drosera capensis*, *Drosera schizandra*, and a *Sarracenia rubra* into pure coco peat to see how they would fare. The results have been disappointing, although all the plants are still alive as I write this in late summer. The two *Drosera* are dwarfed and sickly looking. The Flytrap, too, appears pale and less vigorous compared to others in *Sphagnum* peat growing right beside it in my greenhouse. The *Sarracenia* does not look too bad, but it is still not as vibrant as others of its genus transplanted at the same time into *Sphagnum* peat.

The most noticeable difference between the two peats is that coco peat breaks down much faster than *Sphagnum* peat—at least when used pure. When kept wet-to-waterlogged it becomes a mushy, oozy, slimy soil upon which algae grow rather successfully. Its original fibrous, airy consistency is reduced to a glop of unoxygenated, root-suffocating, bacteria-ridden pulp! Perhaps it would fare better if mixed with abundant sand or perlite, which is what I usually do when using *Sphagnum* peat. But I have used pure *Sphagnum* peat as a soil medium without additives like sand, and it never broke down as rapidly as this coco stuff. It might still be useful as an additive to coarser soils such as those for *Nepenthes* or *Heliamphora*, but I doubt if I will experiment further. Yuck!

Miracid + Mexican *Pinguicula* = Death!

Acidic fertilizers such as Miracid (From the Miracle Grow people) is a wonderful fertilizer to use on acid soil loving plants like *Sarracenia*. When diluted to about half the manufacturer's recommended strength, it can be sprayed or sprinkled upon the foliage once or twice a month during the growing season with great success.

Many Mexican butterworts, however, are often found growing in alkaline soils, some even on pure gypsum. Whenever I have fertilized my Mexican *Pinguicula*, I have always used the epiphytic fertilizer Epiphytes Delight, or an orchid 30-10-10 fertilizer, with very good results.

This past summer I made a horrible mistake. I was using a sprinkle-can filled with a 50% solution of Miracid and was happily walking down the isle of my greenhouse nursery, liberally drizzling the fertilizer over our *Sarracenia* display. I should have stopped where our butterwort collection begins on the bench, but no, I kept going without thinking and saturated all of our *Pinguicula* with Miracid! I realized what I had done, hesitated doubtfully for a moment, then shrugged it off and went about my merry way.

Within just a few days, the effect was devastating on many of the Mexican *Pinguicula*. Shriveled leaves, limp leaves, deformed leaves abounded. Many plants were black mush within a week. To remedy the situation, I took agricultural lime (made of pulverized oyster shells) and mixed about half a cup per gallon of water and saturated the survivors. They seem to be making a slow recovery, but we had to throw out many plants, such as *P. laueana*, *P.* × 'Sethos', many *P. moranensis* varieties, and a hybrid that is going to be named 'John Rizzi' as a cultivar. A few plants

seemed not to be so badly affected, such as *P. esseriana* and *P. rotundiflora*, but these exceptions proved the rule since they are more closely related to northern acid-loving butterworts like *P. vulgaris* and *P. grandiflora*.

In fact, the acid-loving butterworts (such as *P. primuliflora*, *P. lusitanica*, and *P. longifolia*) that received the same dosage of Miracid thrived. I did not, of course, apply the lime to them.

Temperate *Pinguicula* in a Warm Climate

There is something I neglected to mention in my book, The Savage Garden, about growing temperate, winter hibernacula-forming species of butterworts in greenhouses or warmer climates. Species such as *P. grandiflora*, *P. longiflora*, and *P. macroceras* form dormant hibernacula to survive cold weather. Apparently, at least in cultivation, they will also form hibernacula to survive excessive heat in the summer!

As an example, I have been growing various subspecies of *P. longifolia* (native to France and northern Spain) for almost a decade, since *Pinguicula* specialist Jürg Steiger gave specimens to me. These plants have grown quite well year after year, but on an unusual growing cycle in my California greenhouse. They come into growth early, during February and March. They flower during spring and produce lovely rosettes of leaves. But then, usually around mid-July, the plants go dormant again! They remain in hibernacula form through August, then most briefly return to growth in late September and October. By December and the start of winter, they are dormant again.

I suspect this occurs not because of photoperiod or air temperatures differences from their native habitats, but rather because the soil in their pots becomes excessively warm. In their native haunts, cool ground water trickles through the soil even when the air gets warm during the summer. In cultivation, the medium in the pots becomes so warm the plants go dormant, only to return to growth when the soil cools down.

Literature Reviews

Cheek, M., Schnell, D., Reveal, J.L., and Schlauer, J. (1997) Proposal to conserve the name *Sarracenia purpurea* (Sarraceniaceae) with a new type, Taxon, 46, pp. 781-783.

As has been previously described in this journal (see Carniv. Pl. Newslett. 22:78 (1993), 23:69 (1994)) there has been some recent nomenclatural discussion about *Sarracenia purpurea*. Despite the fact that nearly everyone knows the northern form of the species as *S. purpurea* subsp. *purpurea* and the southern form as *S. purpurea* subsp. *venosa*, it was discovered that, according to rules of botanical precedence, the southern species should be called *S. purpurea* subsp. *purpurea* while the northern one should be called *S. purpurea* subsp. *gibbosa* (or, if you preferred, *S. purpurea* var. *terrae-novae*). The authors note this would be a terribly foolish and confusing thing to do, so they proposed a new type specimen. So if this proposal is accepted by the appropriate committee at the next Botanical Congress we may all relax, the northern plant will stay *S. purpurea* subsp. *purpurea*, and the southern plant will remain S. *purpurea* subsp. *venosa*. (BAMR)

Heard, S.B. (1998) Capture Rates of Invertebrate Prey by the Pitcher Plant, *Sarracenia purpurea* L., Am. Midl. Nat., 139, pp. 79-89.

The author monitored *Sarracenia purpurea* subsp. *purpurea* plants growing in the wild in Newfoundland, Canada, for three years. The author visited the plants every three days during the summer months and extracted all the prey from the pitchers. Of 4780 captures, the four largest categories of prey (by dry mass) were ants (26%), beetles (23%), slugs and snails (20%), and dipterans (12%). An average pitcher caught but 11.02 mg dry mass over its entire lifetime! This study verified the previously known fact that pitchers catch prey most rapidly when they are 12-33 days old, although why this is the case is still unknown. It was also shown that pitcher leaves capture approximately the same amount of prey during their second year as during their first. The leaves of other pitcher plant species are mostly inoperative after one year. Perhaps this is one reason *S. purpurea* is such a successful (widespread) species? It would be interesting to test if *S. purpurea* leaves are still actively carnivorous in their second year. (BAMR).

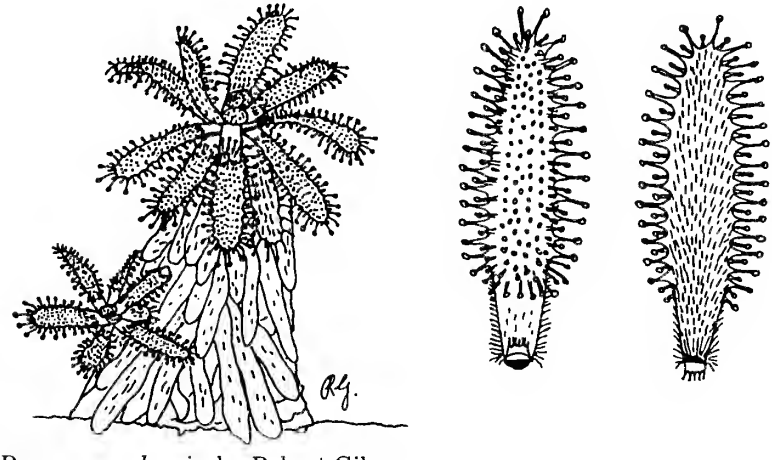
Radhamanim, T.R., Sudarshana, L., Krishnan-Rani 1995, Defense and Carnivory: Dual Role of Bracts in *Passiflora foetida*, Journal of Biosciences (Bangalore), vol. 20, pp. 657-664.

This interesting article about the possibly carnivorous nature of *Passiflora foetida* has hitherto escaped the attention of the CPN editors (and perhaps some readers' attention as well). So we hasten to communicate the information to those of you who might have missed it. It has been known for some time that some members (subgenera Dysosmia and Dysosmioides, together some 18 species all from Central and Southern America) of the large genus *Passiflora* (ca. 470 species) possess the ability to capture and kill insects. In the present work *P. foetida*, a pantropical weed and the most variable species in the genus, has been tested for the carnivorous syndrome in remarkable detail. The flowers of *P. foetida* are subtended by persistent, repeatedly pinnately divided bracts with stalked, vascularized glands at their margins, which ooze with a sticky secretion. Removal of the bracts from developing buds and fruits resulted in higher predatory damage compared to controls with intact bracts. Small insects were found trapped by the secretion of the bracts. The secretions of these glands showed protease and acid phosphatase activity, two common digestive enzymes found in traps of carnivorous plants. Amino acids were released from freshly freeze-killed ants when incubated in aqueous buffered extracts of the bracts. ^{14}C-phenylalanine smeared on the glandular surface of the bracts was recov-

ered from ovules, suggesting a potential for absorption and redistribution of amino acids. These results indicate a novel role for bracts besides their primary function to minimize predatory damage to developing flowers and fruits. The bracts serve as insect traps and obviously also possess the ability to digest the trapped insects in order to obtain free amino acids.
Besides *Triphyophyllum* (Dioncophyllaceae) this might constitute another case of carnivory within a family of mostly non-carnivorous plants. It would be the first instance of carnivorous members in an otherwise non-carnivorous genus. The other subgenera of *Passiflora* (besides Dysosmia and Dysosmioides) and the other genera of Passifloraceae do not have sticky glands, but they frequently have extrafloral nectaries on the leaf stalks or leaf blades. Like in the order Nepenthales (cf. Carniv. Pl. Newslett. 26: 34-38), Passifloraceae with different levels of carnivorous specialisation may allow further insight into the mechanisms and processes of carnivorous plant evolution. Further study is required and in progress. (JS)

Silva, T.R.d.S. and Giulietti, A.M. (1997) Levantamento das Droseraceae do Brasil (Survey of Droseraceae of Brazil, in Portuguese), Bol. Bot. Univ. Sao Paulo, vol. 16, pp. 75-105.

In the present attempt at a survey of Brazilian sundews, 15 taxa are recognized. The reader-friendly aspect of the work is its high compatibility (except for the addition of the recently described *Drosera graomogolensis* and minor taxonomic adjustments) with the classical treatment by Diels. Considering more recent insights from the results of extensive field work, e.g. by F. Rivadavia from the same institution as the first author of the present paper, however, this traditionalism is also the greatest drawback of the text, which is interspersed with several oversights. While *D. roraimae* is accepted as a Brazilian taxon, *D. meristocaulis* is not, although the latter species occurs at the Venezuelan-Brazilian border. The recently described *D. pumila* is nowhere mentioned in the text. Although numerous specimens are cited for *D. montana*, the distribution map (fig. 3) does not show a single locality for this species. Localities of *D. intermedia* on the same map are indicated by a symbol different from that used in the legend. Taxonomic discussions are rather brief, and almost no synonymy is given. This essentially precludes any evaluation of the results. The positive aspects are distribution (dot-)maps for most of the discussed species and rather adequate line drawings of all taxa accepted in the paper. The paper is recommended to those interested in the Brazilian species of *Drosera* but it is hopefully not the last word from the first author, who is obviously preparing a monograph for Flora Neotropica. (JS)



D. graomogolensis, by Robert Gibson.

A Digression Upon James Taplin, *Nepenthes* Hybridizer (Nepenthaceae)

Robert A. DeFilipps
Floristics Office
Department of Botany, NHB 166
National Museum of Natural History
Smithsonian Institution
Washington, D.C. 20560

Keywords: history: James Taplin, *Nepenthes*.

Queen Victoria (1819—1901) presided over an era of unprecedented geographical exploration, resulting in a treasury of newly discovered biota from the far corners of the globe. The tropical plant novelties were destined for elaborate Wardian cases, greenhouses and conservatories. A feel for the kaleidoscopic activities of the late Victorian Age is given by Lynn Barber (1980), who noted that "almost every year produced a new sensation—new orchids, hummingbirds, pitcher plants, toucans, bird-eating spiders, giant tortoises, moon moths from Java, the *Victoria regia* water lily." The "pitcher plants" referred to in the quotation are the *Nepenthes*, which served as raw material for several dedicated hybridizers of the late 1800's, including the subject of this article, Mr. James P. Taplin. Coincidentally, he worked for a time at Chatsworth in England, where the royal water lily from British Guiana, the *Victoria amazonica* ("*V. regia*") mentioned in the quotation, was first brought into flower by Sir Joseph Paxton (Heeps, 1968). I became curious about James Taplin after noticing an assortment of dried specimens of cultivated *Nepenthes* which had been collected by A.L. Schott and deposited in the U.S. National Herbarium, all but two of which were collected on January 7, 1887 at the United States Botanic Garden in Washington, D.C. The label-names on the specimens are *Nepenthes albomarginata, N. dominiana, N. hookeri* (collected September 20, 1886), *N. laevis, N. mastersiana, N. phyllamphora, N.* × *morganiana, N. pattersonii, N. rafflesiana* and *N.* × *sedenii*. One unidentified specimen collected by the same person in 1885, with the locality stated only as "District of Columbia," is also present. While looking for information about these species, it was soon learned that *Nepenthes* × *morganiana* was a hybrid made by a certain Mr. James Taplin, a Briton who had emigrated to the United States, but further data about him was exceedingly hard to trace.

Figure 1: *N.* × *henryana* photographed by B. Bednar.

Before continuing with a consideration of the hybridist Taplin, it is interesting to note that virtually nothing seems to be known about the aforementioned Schott's organizational affiliation or personal history. His general collections were made in the

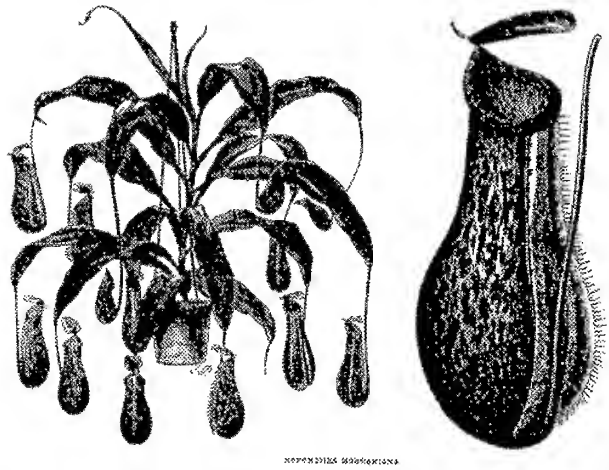


Figure 2: *Nepenthes* × *morganiana* from a Siebrecht and Wadley catalogue.

eastern United States and total about 200—500 sheets deposited in the U.S. National Herbarium, and it is often debatable whether any given specimen is from wild, or cultivated, material. The living *Nepenthes* specimens from which Schott's collections were made are, of course, long gone from the conservatories of the Botanic Garden. Today the garden, located within sight of the U.S. Capitol building, attracts many visitors from all parts of the world, who are intrigued by the impressive controlled-environment growth chamber displaying vigorous specimens of *Nepenthes burkei, N. gracilis, N. macfarlanei, N.* × *mixta* 'Superba', *N. reinwardtiana, N. ventricosa* × *alata*, *N. rafflesiana*, and others.

It seems a gratifying coincidence that one of the popular species which was being grown at the botanic garden and collected by Schott over one hundred years ago, *N. rafflesiana*, is still represented in its living exhibits, though the plant assuredly is not a descendant of the earlier 1887 germplasm. Incidentally, a specimen of *Nepenthes rafflesiana* (originally identified as *N. ampullaria*), collected on the historic Wilkes Expedition (U.S. South Seas Exploring Expedition of 1838—1842), is filed in the U.S. National Herbarium. It is one of the 50,000 herbarium specimens collected on the expedition, and they became the core of the nascent U.S. National Herbarium, now located in the Smithsonian's National Museum of Natural History (Eyde, 1985, 1986). Living plants of various other kinds were brought back from the expedition, to become the foundation display material for the fledgling U.S. Botanic Garden. Also historically significant is the fact that the California pitcher plant or cobra lily, *Darlingtonia californica*, which was eventually named by John Torrey in Smithsonian Contributions to Knowledge 6: 5 (1854), was first discovered by W.D. Brackenridge on the Pacific Coast leg of the epic Wilkes voyage.

During his tenure as gardener at Chatsworth, Mr. Taplin would have had access to living *Nepenthes* and built up an experience in growing them, for seedlings were being raised there as early as the era of 1830—1860 (Macfarlane, 1916). In fact, when the 14-year old Princess Victoria (later Queen Victoria) visited Chatsworth in 1832, she remarked in her daily diary that the pitcher plants in the conservatory were beautiful (Markham, 1935). A vigorous, 20-foot tall, 50-pitchered, and literally "caged" specimen of *Nepenthes distillatoria* at Chatsworth was, as early as 1838, proclaimed by gardener Joseph Paxton to be "without doubt...the finest grown specimen in Britain."

Paxton, who had a brilliant career in horticulture and public service, left Chatsworth in 1858, and his letter of resignation, dated January 27, 1858, said that he would help find a successor to manage the property (Markham, 1935). Several positions in property and business management, and presumably gardening, became vacant as a result of his leaving (also, numerous workmen had to be dismissed). James Taplin, an experienced gardener who had worked on some of the finest gardens in England, was duly appointed head gardener to His Grace the Duke of Devonshire at Chatsworth, to succeed Sir Joseph Paxton on an estate which employed around 130 gardeners (Anon., 1892; Heeps, 1968). Paxton occupied himself with other matters after leaving Chatsworth, and died in 1865; Taplin himself left Chatsworth in 1864 and emigrated to the United States.

In America, Taplin took a position in charge of the florist business of Mr. George Such in South Amboy, New Jersey, where he created numerous hybrids of *Nepenthes*. The Taplin hybrid *N.* × *morganiana* evidently reached the national botanic garden in Washington, D.C. from the Such nursery by 1886, only about five or six years after the progeny of the cross were available for distribution, judging by the January 1887 date of Schott's collection.

Filed with the century-old Schott herbarium specimen of *N.* × *morganiana* is a drawing (Figure 2) which decades ago had been cut-and-pasted from an old nursery trade catalog. The origin of this picture can only be conjectured from a partial heading on a strip at the top of the image, showing it to be page "50" of a Siebrecht and Wadley trade catalog. More information becomes evident from the printing on the butchered-and-glued reverse of the page by holding it up to a light and reading through the back of the nearly opaque herbarium sheet. The reverse of the sheet bears an undated list of *Nepenthes* for sale by the Siebrecht & Sons nursery, and also has a woodcut drawing of *N.* × *hookeriana*. Neither the *N.* × *morganiana* nor *N.* × *hookeriana* drawings are cited in the venerable Index Londinensis guide to illustrations. Later it was ascertained, through research in the Horticulture Library of the Smithsonian Institution, that the plants were being sold by Siebrecht & Son at Rose Hill Nurseries, located in New Rochelle, New York. The source of that data was extrapolated from Siebrecht & Son (1897), a publication which is not, however, one of the annual descriptive trade catalogs which they produced over many years, and in which the catalog-illustration in question was published; that date remains unknown. The general list of stove and greenhouse plants from the 1897 publication reveals that Siebrecht & Son (established 1867) stocked 36 species, varieties and hybrids of *Nepenthes*, offering *N.* × *morganiana* for $3.50 to $5.00 each. The Siebrecht name is commemorated in the hybrid *Nepenthes* × *siebrechtiana* Siebrecht & Wadley [Cat.: 51. 1889] ex Miller, Cycl. Amer. Hort. 3: 1074 (1901), a plant with the parentage of *N. mirabilis* × (*N. gracilis* × *N. khasiana*). Siebrecht & Son (1897) noted it was "one of the grandest new hybrids yet introduced, a free and vigorous grower, producing its immense pitchers freely."

As previously noted, in 1864 Taplin relinquished his position at Chatsworth, and emigrated to the United States and the Such establishment. There, he produced numerous tropical plants and often exhibited them at Madison Square Garden in New York City when the New York Horticultural Society was holding its shows there. While employed by Such, he made many *Nepenthes* hybrids (Such, 1881), and most of these new entities were brought into the British nursery trade through sales of seedlings to Mr. Alfred Outram (1847—1899), a traveling representative for the Benjamin S. Williams firm of Upper Holloway, London. With the exception of *N.* × *morganiana* (see Appendix below), the only Taplin hybrid not given a Williams launching for overseas sales would appear to have been *N.* × *atrosanguinea*, which was, like Mrs. Morgan's *Nepenthes*, also brought into London com-

Figure 3: *N.* × *morganiana*, grown by P. D'Amato, photographed by B. Meyers-Rice.

merce by the Veitch company.

By a curious twist of fate, the only *Nepenthes* named in honor of Mr. Taplin, the hybrid *N.* × *taplinii* Hort. ex Miller, Cycl. Amer. Hort. 3: 1074 (1901), is or was a hybrid of unknown parentage. James Taplin published several articles on plants other than *Nepenthes*, including the two listed below from 1891. A relative of his, W.H. Taplin residing in Holmesburg, Pennsylvania, perhaps his son, was also a gardener and horticulturist but a much more prolific writer, among whose numerous articles is one on *Sarracenia* (Taplin, W.H., 1890).

James Taplin died at age 61 on January 9, 1892 at his home in Maywood, New Jersey, of bronchial pneumonia brought on by an attack of influenza (Anonymous, 1892). In addition to an obituary in American Florist (not seen) and the two cited below as Anonymous (1892), his passing was remarked in a *Nepenthes* article by W.H. Taplin (1892), who stated that "many of the first and finest hybrids on this side of the water were originated by the late James Taplin, who crossed several species 16 or 18 years ago."

Taplin's destiny had carried him a long way from the village of Overton in Hampshire where he was born, going through a series of increasingly important gardening positions on fine English estates which would culminate at Chatsworth as Paxton's successor, and leading across the Atlantic to New Jersey where he created the *Nepenthes* hybrids. After Mr. Such went out of business and disposed of his plant stock in 1879, Taplin purchased a farm in Maywood, New Jersey and resided there with his family until his death, where he worked until the end as a wholesale plant grower for the New York market, specializing in hardy flowering shrubs.

Appendix

Nepenthes Hybrids made by J. Taplin at the Such Firm
(Extracted mostly from Macfarlane, 1908)

N. × *atrosanguinea* Masters, Gard. Chron. 17: 826 (1882). (Probably *N. distillatoria* × *N.* × *sedenii*)

N. × *coccinea* Hort. ex Masters, Gard. Chron. 18: 169 (1882). (*N. hookeriana* × *N. phyllamphora*)

N. × *compacta* Hort. ex Baines, Garden 27: 496 (1885). (*N. hookeriana* ? × *N. phyllamphora*)

N. × *dormanniana* Williams ex Masters, Gard. Chron. 17: 525 (1882). (Probably *N. mirabilis* × *N.* × *sedenii*)

N. × *excelsior* Williams, Garden 28: 463 (1885). (*N. rafflesiana* × *N. hookeriana*)

N. × *findlayana* Hort. ex Nicholson, Dict. Gard. Suppl. 572 (1988). (Advertised in Williams Cat. 23 (1886), and therefore possibly a Taplin hybrid; parentage unrecorded)

N. × *henryana* Williams, Ill. Hort. 29: 125 (1882). (*N. hookeriana* × *N.* × *sedenii*)

N. × *hibberdii* Nicholson, Dict. Gard. Suppl. 572 (1888). (*N.* × *hookeriana* × *N.* × *sedenii*)

N. × *hookerae* Hort. ex G. Beck, Wien. Ill. Gartenztg. 20:222 (1895). (*N. rafflesiana* × *N. mirabilis*)

N. × *lawrenciana* Masters, Gard. Chron. 14: 40 (1880). (Probably *N. phyllamphora* × *N. hookeriana*)

N. × *morganiana* Hort. Veitch ex Masters, Gard. Chron. 16: 381 (1881). (Probably *N. phyllamphora* × *N. hookeriana*. It was originally given the trade name *morganiana* by G. Such (1881) in honor of Mrs. Morgan of New York, to who he sold a plant, and she in turn gave the specimen to a visiting sales representative of Messrs. Veitch & Sons, whereupon it was displayed by the Veitch nursery in Chelsea, London in 1881; a leaf with pitcher is depicted in The Garden 23(602): pl. 390, opp. p. 492 (1883). Cuttings from the original plant were being sold through the Such (New Jersey) catalogue in 1881.)

N. × *outramiana* Williams, Gard. Chron. 12: 505 (1879). (Probably *N.* × *sedenii* × *N. hookeriana*)

N. × *paradisae* Hort. ex Nicholson, Dict. Gard. Suppl. 573 (1888). (*N. hookeriana* ? × *N. phyllamphora*. Named for the Benjamin Williams firm, known as Victoria and Paradise Nurseries, in Upper Holloway, London, and displayed there in 1883)

N. × *robusta* Hort. ex Masters, Gard. Chron. 17: 40 (1880). (*N. phyllamphora* × *N. hookeriana*)

N. × *superba* Williams, Garden 18: 624 (1880). (*N. gracilis* × *N. sedenii*) × *N. hookeriana*)

N. × *williamsii* Masters, Gard. Chron. 14: 40 (1880). (Probably *N.* × *sedenii* × *N. hookeriana*)

Acknowledgements: I am very grateful to Ruth F. Schallert, Marca L. Woodhams, Stanwyn G. Shetler, and Dan H. Nicolson for their guidance in locating literature references and other assistance, and to Shirley L. Maina for accompanying me on a visit to the U.S. Botanic Garden.

A note from the editors: Modern nomenclature for *Nepenthes* has changed since Taplin's day. The following is a list of the plant names used by Taplin, followed by the correct modern or hybrid names in parentheses: *N. dominiana* (*N.* × *dominiana*), *N. hookeri* (*N.* × *hookeriana*), *N. hookeriana* (*N.* × *hookeriana*), *N. laevis* (*N. gracilis*), *N. mastersiana* (*N.* × *mastersiana*), *N. pattersonii* (*N.* × *pattersonii*), *N. phyllamphora* (*N. mirabilis*).

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Carnivory in *Byblis* Revisited II: The Phenomenon of Symbiosis on Insect Trapping Plants

Siegfried Hartmeyer
Wittlinger Str.5
D-79576 Weil am Rhein
Germany
S.Hartmeyer@t-online.de

Keywords: carnivory: *Byblis*, *Drosera*, *Roridula*.
Received: 3 March 1997

Introduction

When people think of carnivorous plants, they mostly think that those little "killers" catch and digest anything they are able to overwhelm. However, carnivorous plants benefit many arthropods, including ants, true bugs, small crawfish, mosquito-larvae and spiders. Furthermore, numerous bacteria and fungi profit from the presence of the captured prey. In some cases the benefit is through sheer robbery, for example when ants steal the prey from a sundew trap. Other times, the ants live on the plant and defend it from herbivores. As they go about their lives, the ants drop mineral rich feces on the leaves or inside the pitchers. This is a case of classic symbiosis in which both sides benefit by the partnership. (The plant also benefits from the more rapid processing of prey into nutrients. This deters fungal development, which is a considerable danger especially for plants that use glue traps but that do not produce enzymes.) This kind of symbiosis is exploited by the non-carnivorous tobacco plant (*Nicotiana tabacum*) which has gluey regions that protect the plant from herbivores. These zones are cleaned by resident true bugs (*Engitatus tenuis*). An analogous cleaning symbiosis is well known from cleaning stations in coral reef habitats, where specialized shrimp and fish clean parasites off much bigger species.

Other relationships occur which are borderline-symbiotic. For example, a small red crawfish (*Geosesarma malayanum*) raids *Nepenthes ampullaria* pitchers. It uses its claws to crush and consume the drowned prey in a wasteful way. The crushing speeds digestion, which compensates for the loss of part of the prey. This situation would be a true symbiosis only if the crawfish were specialized to coexist with the carnivorous plant population.

It is necessary to understand the details of symbiosis because a new discussion about carnivory in plants is beginning. This is important for plants (perhaps even including tobacco) which use glue traps. The results of recent investigations about the plant-arthropod mutualism in *Roridula gorgonias* and about the enzyme production on *Byblis liniflora* are discussed below.

Is *Roridula* Carnivorous?

Roridula is a South African genus containing two shrubby species which bear stalked glands that produce an effective India rubber-containing glue. The carnivorous status of species in *Roridula* has been debated ever since Charles Darwin first suggested they were carnivores (1875). Work by Marloth (1910) and Lloyd (1935) countered Darwin's conclusions because the sticky shrublets do not have the sessile glands that produce proteolytic enzymes and which absorb nutrients (as does *Drosophyllum*). *Roridula* was repeatedly shown to be unable to produce digesting

Figure 1: Symbiotic bug on *Roridula gorgonias*. Photo by Matthias Schmidt.

enzymes, so it was theorized that these plants (that have the strongest glue of all the insect-trappers) only benefited from the captured prey when nutrients from the decaying prey washed into the soil. Capsid bugs (Miridae) which live on the plants were postulated as representing another loss to the plant because, astonishingly, they freely move on the plant and steal the immobilized insects. Furthermore, some species of spiders use their webs to avoid the plant's glue and feed upon the Capsid bugs and arthropods stuck to the plant. But in spite of all this, Darwin's theory remained popular and *Roridula* continues to be grown by carnivorous plant enthusiasts.

During 1991 to 1996 I raised two plants of *Roridula gorgonias* in my living room in Weil am Rhein, Germany. They were 1.2 m tall, and had a good population of *Pameridea* bugs. The bugs remained on their host plant and only on rare occasions the adults used their wings for a reconnaissance of our house (no persons were attacked!). On sunny days, when I moved the plants to my balcony, the bugs did not try to escape. During the winter I fed the bugs with beetle larvae from pet shops, and in the summer the plants caught enough flies and wasps for the bugs. When arthropods were captured in abundance, the bug population grew so large the plant was nearly suffocated by their feces (in nature the bug population is moderated by spiders. By feeding the plant in moderation, there were fewer feces and they gradually became paler and paler until they practically disappeared (this happened even indoors). One year the plants were so vigorous they produced sixty beautiful pink flowers! This is documented in my first English-language video (1994), in which I suggested it was an example of a true symbiosis. I soon became involved in the heated discussion regarding the carnivorous status of *Roridula*. I maintained that *Roridula* is a true carnivorous plant even though it does not have enzymes that can dissolve its captured prey. I think the nutrition is not absorbed via soil fertilization but much more effectively through the predigested feces of its *Pameridea* partners. I think the definition of true carnivorous plants (that is, trapping of prey, digestion of prey by proteolytic enzymes, and absorbing the nutrients) should include the passive digestion by true symbiosis, as long as the nutrients are absorbed.

Figure 2: Symbiotic bug on *Roridula gorgonias*. Photo by Matthias Schmidt.

Supporting evidence appeared in 1996, when Ellis and Midgley published detailed and highly interesting examinations. They used a method developed by Dixon *et al.* (1980), who traced the ^{15}N nitrogen uptake in *Drosera erythrorhiza*. Yeast was combined with ammonium sulfate tagged with ^{15}N, and this mixture was fed to fruit flies (*Drosophila melanogaster*) for five days. Ellis and Midgley tested plants in the field and in the laboratory, both with and without *Pameridea* bugs present. The fruit flies were placed on the plants, and eaten by the

Pameridea bugs. Several leaves of the plants were later removed, cleaned of impurities, and their ^{15}N isotope content was analyzed. The plants with resident bugs showed a clearly higher ^{15}N content, particularly in newly formed leaves. This confirms the *Roridula-Pameridea* symbiosis. *Roridula* seems to absorb the feces via stomata, as do many other non-carnivorous plants. *Roridula* clearly benefits from its captured arthropods more efficiently than it would by soil fertilization. However, it is truly carnivorous?

Are *Byblis* and *Darlingtonia* Carnivorous?

Near Perth Australia, China (1953) reported Capsid bugs on carnivorous plants, specifically *Setocornis bybliphilus* on *Byblis gigantea* and two *Cyrtopeltis* species on tuberous *Drosera*. Unfortunately, during our visit there in 1991, my wife Irmgard and I saw no Capsids on *B. gigantea*, and the tuberous *Drosera* were dormant. In May 1995, while filming *B. liniflora* near Kununurra, North Australia for our latest video (1995), we immediately found numerous bugs living on them. The similarity of their behavior to that of *Pameridea* bugs on *Roridula* was amazing. Although they were a little smaller, they had the same dotted pattern on their back (typical for the family Miridae), the same appetite for the plant's prey, and the phenomenal ability to use the glue drops as a cooling agent without becoming entrapped. We filmed a smaller Miridae bug on *Drosera ordensis* and two more species on *Drosera indica* variants near Darwin.

Like mosquito larvae living in *Nepenthes* pitchers, I thought the bugs we were observing must have some kind of defense against proteolytic enzymes produced by the host plants. However, I discovered that bugs living on *Byblis liniflora* may not require such protection. In a series of simple experiments using photographic film to test carnivorous plants for enzymes, I examined several *Drosera* species, *Byblis liniflora*, and *Roridula dentata* (Hartmeyer, 1997). Enzymes were detected by their ability to digest the gelatin layer of the photographic film. While all the sundews were shown to produce enzymes (as expected), none of the trials detected enzyme production in *Byblis liniflora*! Those plants capable of digesting the gelatin protein on photographic film can also digest animal protein. Conversely, a plant unable to digest the gelatin layer on film is also unable to digest animal protein. Recall that *Byblis liniflora* has sessile glands for nutrient absorption which *Roridula* lacks. However, these results suggest the *Byblis-Setocornis* mutualism (and probably also the *Byblis-Cyrtopeltis* mutualism) may be much more similar to the *Roridula-Pameridea* mutualism than previously believed. Although Bruce (1905) reported on digestive enzymes in *Byblis gigantea*, the fact that none were found in *Byblis liniflora* recently sheds serious doubt on the carnivory of the genus.

Incidentally, enzymes are not produced by *Darlingtonia californica* or some *Heliamphora* species. Are they not carnivorous? Carnivorous plant enthusiasts need not despair—there is hope for their Cobra Lilies and expensive Pitcher Plants. Both genera have symbioses with arthropods. Along these lines, numerous associations between carnivorous plants and animals are featured in a recent documentary (Carow, 1996). Just enlarge the definition of carnivory to include this situation!

Conclusion

The production of enzymes should not be a prerequisite for a plant to be considered carnivorous—a symbiosis with another digesting agent should be sufficient. In the past, symbioses were mistakenly considered strange exceptions, but now it is apparently a widespread syndrome with carnivorous plants. Indeed, with some plants it is an integrated part of the digestive system! All the plants commonly considered carnivorous but which do not produce enzymes have symbioses with arthropods. I hope these new examinations of *Byblis liniflora* and *Roridula gorgonias* trigger interesting discussions on the subject.

Plant	Arthropod	Occurrence
Byblis gigantea	*Setocornis bybliphilus*	Perth, Australia
Byblis liniflora	*Setocornis / Cyrtopeltis* species	Kununurra & Cairns, Australia
Darlingtonia californica	*Metriocnemus edwardsi*	USA
Drosera erythrorhiza	*Cyrtopeltis droserae, C. russelli*	Perth, Australia
Drosera pallida	*Cyrtopeltis droserae, C. russelli*	Perth, Australia
Drosera stolonifera	*Cyrtopeltis droserae, C. russelli*	Perth, Australia
Drosera indica varieties	*Setocornis / Cyrtopeltis* species	Kununurra & Darwin, Australia
Drosera ordensis	A tiny Miridae species	North Australia
Heliamphora	Several mosquito larvae	Venezuela
Nepenthes bicalcarata	*Camponatus schmitzi* *Misumenops nepenthicola* *Thomisus nepenthiphilus* Mosquito larvae	Borneo
Various *Nepenthes*	Several mosquito larvae	Asia, Australia, Madagascar, Seychelles
Roridula dentata	*Pameridea marlothii*	South Africa
Roridula gorgonias	*Pameridea roridulae*	South Africa
Sarracenia flava	*Sarcophaga*	USA
Sarracenia purpurea	*Wyeomyia smithii*	USA, Canada

Table 1: Examples of plant-animal mutualism in carnivorous plants and allies

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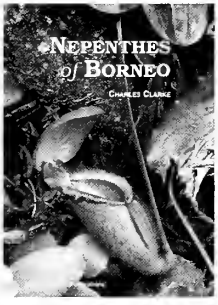
Book Review

Clarke, Charles. 1997. *Nepenthes* of Borneo. Natural History Publications, ISBN 983-812-015-4, 207 p. + xi, approximately 122 color photographs. Hardcover, 19 × 26 cm (7.5 × 10.25 in), RM195 (approximately US$ 51), RM215 (approximately US$ 57) for the limited edition.

Reviewed by Barry Meyers-Rice



Nepenthes are hot! Jebb & Cheek have recently published a skeletal revision of the genus, and Natural History Publications has printed Pitcher-Plants of Borneo (see review in CPN 27:1, p53). Natural History Publications has followed their book with a new volume, *Nepenthes* of Borneo.

Borneo is the center of diversity for *Nepenthes*, and Charles Clarke has been studying them there since 1987. His research has given him the experience necessary to produce this good, solid book that treats its subject very well. As you might expect, all the Bornean species and a number of natural hybrids are lavishly described (other botanists might have included other species in this section.) There is also the obligatory material about *Nepenthes* history and morphology. These are all well-executed (although Clarke perpetuates the mistaken notions about the parts of an individual leaf—nowhere does he state that the broad part of the leaf that he calls the lamina is an enlarged leaf base, that the tendril is the petiole, and that the pitcher is actually the modified leaf blade). I am happy to see Clarke uses an entire chapter to present a reasoned and even-handed discussion of conservation issues

Content that really makes this book interesting and different from other carnivorous plant books is its emphasis on the context of *Nepenthes* in its natural habitat. For example, the first part of chapter three discusses the ecozones *Nepenthes* inhabit, the second part describes the many creatures which inhabit *Nepenthes*! Now the plants in my collection seem like incomplete shadows of their wild brothers and sisters living in, and housing, the wild.

All carnivorous plant enthusiasts interested in *Nepenthes* should buy this book. Its photographs alone make it worth the cost! It can be bought directly from the publishers at Natural History Publications, A913, 9th Floor, Wisma Merdeka, P.O. Box 13908, 88846 Kota Kinabalu, Sabah, Malaysia (email: chewlun@tm.net.my). The limited edition version is signed and includes a special sleeve which may be of interest to the book collector. A follow-up volume of *Nepenthes* in peninsular Malaysia is also being prepared by Clarke, and I hope it is as fine as this excellent book.

Sarracenia flava L. Varieties

Donald Schnell
Rt. 1, Box 145C
Pulaski, VA 24301 USA

Received: 24 August 1998
Keywords: field studies: *Sarracenia flava*, new taxa: *Sarracenia flava* var. *cuprea*, *Sarracenia flava* var. *rubricorpora.*

Introduction

Since writing a brief note in Carnivorous Plant Newsletter a few years ago (Schnell, 1995) warning about problems applying wrong or inappropriate names to perceived varieties of *Sarracenia flava* L. and giving a few examples, I have been asked to do a more complete treatment of this problem. At first, the task seemed daunting because of the older literature involved, the seemingly endless proliferation of "names" applied to *Sarracenia* at all levels by the happy British gardeners of the late nineteenth century, and even what has happened more recently as equally happy carnivorous plant people working in the field and in horticultural efforts all too often merrily call whatever they see whatever they want without research or proper basic documentation. Of course, only a few are guilty of the latter trespass, but their comments tend to become fixed in place over time, lately in particular if they appear on the world wide web!

When we speak of variations in *S. flava* in particular, we mainly refer to red pigmentation—whether there is any; and if so, how it is disposed on the pitcher. Are there veins, the famous "purple splotch" in the throat, any diffuse pigmentation, and how are they interrelated? To some degree, one can also speak of relative pitcher size, lid size and expansion of the upper portion of the pitcher, but my studies show that it all mainly comes down to red pigment, other features being ancillary.

Red pigment in *Sarracenia* is a very complex subject and cannot be evaluated for either genetic or taxonomic purposes in simple presence/absence terms. One must consider several aspects in plants that are a few years old and produce mature pitchers: 1) Presence or absence of red pigment; 2) Extent or amount of red color present; 3) Pattern of red pigment in pitchers and other structures; and 4) "Shade" of red pigment present (which may be noted with the use of extended length standard horticultural color charts if necessary). Red pigment expression and regulation in *Sarracenia* is very likely polygenic.

Very brief mention of a few of the many early writings I reviewed on *Sarracenia* seems in order to put the problem in perspective.

Two interesting early papers are by Manda (1892) and Burbidge (1905). They are fun to read in light of the past and present times, but by themselves would be terribly confusing and misleading. Manda was a horticulturist and read his paper before the Royal Horticultural Society in 1892 on the subject "Insect-eating Plants." When he got to *Sarracenia*, he listed twenty-five "names" in italics with comment after most (but not all!) as whether they were considered a species or hybrid. There is no indication of what might have been cultivar names and there are no physical descriptions of characters of the plants other than subjective comments on their attractiveness and distinctiveness. Some of the hybrid diagnoses are correct, but many are not. A few *S. flava* varieties are listed as hybrids, and vice versa. The plant names have no authorities.

Some seventeen years later, Burbidge did a paper on the "Trumpet-leaved

Pitcher Plants" (1905) and was somewhat more organized with his errors mixed with correct taxa. He listed *Sarracenia* spp. insofar as they were known then, with varieties and some horticulturally interesting hybrids. But this time the varieties were listed under species and all the claimed hybrids were together at the end of the paper. There was no organized list of references, but a paragraph at the end did mention other literature sources casually.

The emphasis in both instances (and many other papers not mentioned here) was on horticulture, not a bad thing in itself, but this emphasis crossed into botanical evaluations as well. If one were interested in a clear history of these plants and relied on these works only and others like them, there would be complete confusion.

Just prior to these two articles, Masters wrote in The Gardeners' Chronicle (1881c), providing a much more logical and a clearer listing of the species as they were known in those days, and listing varieties along with authorities and some morphologic description to the extent that some errors could be seen. For example, *S. flava* var. *crispata* is clearly a nice description of what we now know as *S. alata*, and Masters did express some doubt about varietal status and wondered if it might be a distinct species. So, why did not Manda and Burbidge pick up on this knowledge and quality of presentation with their much later efforts? We may never know.

Distilled from all this, Macfarlane did the Sarraceniaceae section for Das Pflanzenreich (1908) and pared the numerous varieties (?), hybrids (?), etc. of *S. flava* down to a more acceptable but still not entirely accurate summation. As was the habit in those days, the descriptive portion of his monograph, including comments, was written in Latin. For those who have difficulty with Latin, Macfarlane conveniently provided an English adaptation in Bailey (1917). All hybrids were relegated to the end of the monograph. Macfarlane recognized six varieties of *S. flava*, four of which (including the type variety—see below), in my opinion stand today. The other two are likely hybrids.

In more modern literature, the varieties of *S. flava* are usually listed according to Macfarlane (e.g. McDaniel 1966, Bell 1949).

In 1978, I published a paper on *S. flava* variations in eastern North Carolina which applies to all the eastern or Atlantic coastal plain. I reduced the seeming spectrum of variation then easily seen in this region in massive stands to five genetic variants and concluded that all the others were hybrids of these to varying degree. I did not formally name these variants at the time since my research into this aspect of the old literature was incomplete at the time, and I felt there was little interest. I referred to the variants by distinctive (now well-used) informal designations in double quotes, such as "typica", "all red", "heavily-veined", etc. Since then, using similar methodology as in my 1978 study (see original paper for details), I have come to recognize two additional basic varieties on the Gulf Coast to report here.

In the interest of clarification, I am now prepared to assign appropriate varietal epithets to these seven true varieties, five of which are older applicable designations, and two which, although well-known informally, are herein described and published with varietal epithets for the first time.

Varietal status, rather than the higher subspecies level, was chosen for two combined reasons. First, it is my opinion that the variations are not of sufficient degree to warrant the higher status, particularly when considered alongside other *Sarracenia* species infraspecific classification. Secondly, I tend to follow the taxonomic school of thought that subspecies designation is generally reserved for variant groups of a species that are mostly geographically separated (allopatric), and variety used for those variants which occur in the same area or even within a population (sympatric).

1)*Sarracenia flava* var. *flava*
Prominent deep red to purple pigment deposition in pitcher throat with variably prominent red venation radiating from this over lid and upper pitcher tube. Informally, this was previously designated "typica" by me (1978). Since this is the predominant variety in the type area for the species, it automatically bears the specific epithet without authority. Very prominent in the Atlantic coastal plain, currently rare in southeastern Virginia, and far more common in North Carolina and South Carolina. (Figure 1C)

2)*Sarracenia flava* var. *atropurpurea* (Bull) Bell (1949)
Lid and external pitcher tube a deep red in ideal growing conditions, pitcher interior pale tan. Informally, I previously listed this as "all red" (1978) which correlates well with earlier descriptions of var. *atropurpurea*, so of course it is retained here. Uncommon, Atlantic coastal plain of North Carolina and South Carolina, rarer yet in Florida panhandle. (Figure 1B)

3)*Sarracenia flava* var *maxima* Bull *ex* Mast. (1881a)
The epithet is unfortunate for this variety since one would *a priori* suspect it refers to pitcher size, and has been mistakenly used in this respect. In fact, the key early descriptive feature of this variety is that the pitchers are green with no red venation or red coloration of throat. Note: These plants are not the equivalent of anthocyanin-free taxa elsewhere in the genus since the bases of pitchers and cladophylls of var. *maxima* do have some red pigment. Uncommon throughout the range, but most easily found in the Atlantic coastal plain of North Carolina and South Carolina, far less frequent in northwestern Florida. (Figure 1A)

4)*Sarracenia flava* var. *ornata* Bull *ex* Mast. (1881b)
Deep red to purple throat pigmentation nearly obliterated by very strong and heavy red venation throughout pitcher tube and lid. This was informally previously designated "heavily veined" by me (1978). It is frequent in the Atlantic North Carolina and South Carolina coastal plain, far less easily found in northwestern Florida. (Figure 1D)

5)*Sarracenia flava* var. *rugelii* (Shuttlew. *ex* A.DC.) Mast. (1881c)
Top of pitcher more widely expanded and with larger lid than other varieties, prominent large deep red to purple pigment area in pitcher throat that is often fractured with smaller satellite areas but with no significant venation. This variety has erroneously been called var. *maxima* by some. Common and predominant variety in southern Georgia and northwestern Florida. (see Front Cover)

6) ***Sarracenia flava*** L. **var. *cuprea*** Schnell, *var. nov.*
Operculo folii urceolati externo cupreo vel ferrugineo atque parte superiore 1/4 tubi urceolati externi prominente cuprea vel ferruginea distinguenda.
External lid of the pitcher and sometimes upper 1/4 part of the external tube prominently copper-colored or rust-colored.
TYPE LOCALITY. United States. North Carolina. Brunswick County, off State Rt. 211: wet savanna. Herbarium material collected 1 July 1998 from cultivated plants, D.E. Schnell *s.n.* (HOLOTYPUS: US).
ETYMOLOGY. Epithet *cuprea* refers to "copper color."
RANGE. Southeastern coastal plain, most prominent in North Carolina and South Carolina, rare in northwestern Florida.

HABITAT. Open or moderately shaded pine savannas, drainage ditches, seep bogs and along shallow, meandering streams.
This is the variety formerly referred to informally as "copper hooded" or "copper lid" (Schnell 1978). (Figure 1E)

Figure 1: A. *S. flava* var. *maxima*, B. *S. flava* var. *atropurpurea*, C. *S. flava* var. *flava*, D. *S. flava* var. *ornata*, E. *S. flava* var. *cuprea*.


Figure 2: *S. flava* var. *rubricorpora*

7) ***Sarracenia flava*** L. **var. *rubricorpora*** Schnell, *var. nov.*
Folio urceolato extus atrorubro, intus superne flavido-bubalino, operculo flavo-viridi et venationem prominente rubram habente distinguenda.
Pitcher tube externally dark red, internally yellowish-buff, the lid yellow-green and having prominent red venation.
TYPE LOCALITY. United States, Florida. Liberty County, herbarium material collected 1 July 1998 from cultivated plants. D.E. Schnell, *s.n.* (HOLOTYPUS: US).
ETYMOLOGY. "*rubri-*" being red, "*-corpora*" referring to body of pitcher tube.
RANGE. Restricted to northwestern Florida.
HABITAT. Open or moderately shaded pine savannas, ditches and seep bogs.
This strikingly beautiful variety is restricted to the Florida panhandle Gulf Coast and has been widely known and informally referred to for years but not previously formally described. It is not common in the global sense, but often occurs in rather prominent stands when found where it affords a spectacular view. Being a Gulf Coast plant, it was not in my 1978 paper. (Figure 2)

Summary

I recognize seven varieties of *S. flava* worthy of naming, the remaining color and vein presentations of a seeming spectrum in some locations being varietal hybrids or backcrosses, or ecophenes. Five of these—predominantly in the Atlantic coastal plain—were studied and presented in my 1978 paper with informal designations applied until further "library research" could match older formal varietal designations to some of these. One is given the "default" varietal designation var. *flava*, three are matched with previous formal descriptions and varietal names, and one new formal varietal description herein published. On the Gulf Coast, not covered in my 1978 paper, two unique genetic varieties are discerned, one matching a previously published varietal epithet, and the second being formally described herein. All seven of these varieties can now be referred to by formal, accurate varietal names, and there should no longer be confusion about what epithet applies to what variant.

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Pinguicula emarginata—a Variable and Distinctive Mexican Species

Loyd Wix
93 Hayway, Rushden
Northants, NN10 6AQ
United Kingdom
Loyd.Wix@unilever.com

Keywords: cultivation: *Pinguicula emarginata.*

Introduction

Over the past two decades, the ranks of the Mexican *Pinguicula* species have swelled by the publication of numerous new species. In 1986, *P. emarginata* was added to the list by the Mexican botanists Zamudio and Rzedowski (1986). Six years after its publication *P. emarginata* was introduced into cultivation in Europe; by 1994 the species was widely distributed amongst *Pinguicula* growers. This small plant is distinctive and unlikely to be confused with other species. The principle charm of the plant is its delicate beauty combined with the wide variation in flower shape, colouring and venation.

Description

P. emarginata is by no means a large plant—the rosette of foliage reaches a diameter of 9 or 10 cm. The leaves are approximately spoon-shaped with a relatively broad petiole. The leaf margin is rolled upwards to form a distinct edge. Overall the leaf colour is a pale green, though most plants also show reddish-pink pigmentation. In some plants this colour is confined to the up-turned leaf margin to give a reddish-pink band to the leaf edge. In other plants it is the base of the petiole that shows the greatest tinge of pink although this colour may also extend along the mid rib. *P. emarginata* is unusual among the commonly grown Mexican species in that its winter rosette, while compact, is never succulent. A typical late winter-early spring rosette is displayed in Figure 1.

This species flowers prolificly throughout the year. So many flowers are produced during the winter months that *P. emarginata* is a very welcome plant that cheers up these gloomy months. The flowers are unusual in comparison to other Mexican *Pinguicula*. They are quite small—usually around 1 cm in diameter—and held on stalks up to 15 cm tall. The margins of the petals are serrate, which gives the flowers a distinctive notched or frilled appearance. There is incredible variability in the flowers between different clones. Firstly, there is tremendous variation in the size of the petals (particularly the width), and the degree to which the lower three petals overlap. The nature of the serration on the petal margins and the degree of folding are also variable. Secondly, the flower colour is variable. The petals range from near-white to dark-violet and are threaded with deeper coloured veins—the intensity and degree of veining seems as unique to an individual plant as a person's fingerprint. One constant feature, however, is the yellow splotch of colour in the throat. In the United Kingdom horticulturists prefer plants which display the most vivid colouration and veining. Whilst this is understandable if one intends to grow only one representative of this species, it may stereotype the plant. My preference is to maintain several plants which display a range of characteristics—this has additional advantages that I describe below. The flowers displayed on the back cover of this issue display the characteristic darker veining over the pale petals—the veining is strong and intense on the upper petals, although slightly fainter on

the lower petals.

Cultivation

In keeping with the plant's distinctiveness, its cultivation requirements break many of the accepted rules of thumb for Mexican *Pinguicula*. It will grow well in a compost of peat and sand, though it will equally tolerate the perlite-dominated composts now favoured by many *Pinguicula* growers. The plants must be kept wet all year round (they do not form a winter resting rosette). I always keep their pots standing in a few millimeters of water, and the plants are treated to an occasional overhead watering. In their natural habitat the plants grow on sandstone rocks along river banks—given these conditions it is not surprising that in cultivation the species prefers an acidic growth medium and year-round dampness. In my experience the plants will happily tolerate winter low temperatures of 10°C (50°F) with few problems; temperatures of 20°C (68°F) or higher produce somewhat more luxurious growth so long as high humidity is maintained. The plants do not seem to suffer from the general lack of sunlight in the United Kingdom over the winter, as the majority of my plants are kept without the benefit of artificial lighting. In the wild the plant inhabits misty woodland riverbanks, so it is not surprising that this species is tolerant to low light intensities. Care does have to be taken as light intensities increase in late spring/early summer—without shading the delicate foliage is easily burnt by strong sunlight even in the United Kingdom. Humidity is the other factor to monitor closely during the warmer periods of the year—ensure the plants are frequently watered, and occasional misting will also help matters. I suspect that these plants flower less during summer due to the lower humidity and higher light intensities. Although the plants prefer constant dampness they will tolerate a period of drought, to which they respond by producing smaller, fleshier foliage. These leaves are very different from the almost membranous leaves produced during damp conditions.

The best means of propagation is by seed, which readily germinates within a few weeks at 20°C (68°F) on a compost of peat and sand. To generate seed it is necessary to pollinate the flowers with a small brush to fit the relatively small flowers. Few if any seeds are generated by self pollination; the best results are always obtained by cross pollinating different clones. This helps maintain the variability exhibited by this species, and is the reason I maintain a variety of plants (and not just the intensely coloured clones). Leaf cuttings also work but care has to be taken

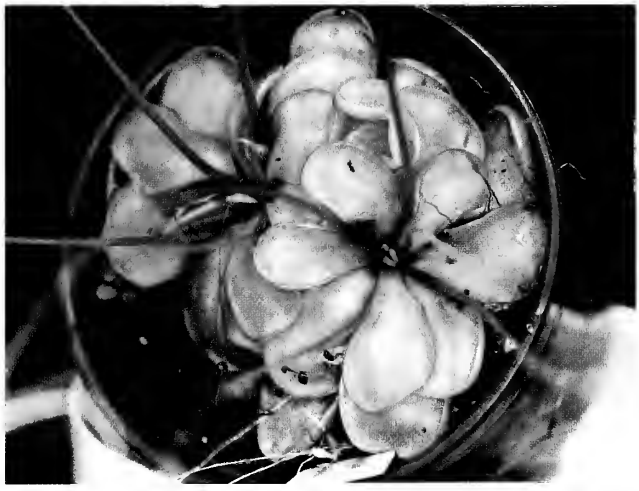

Figure 1: *P. emarginata* in late winter forming flowers.

to avoid excessive damage to the donor plant. This method of propagation is limited by the absence of a suitable winter rosette, where in many other species a large number of cuttings can be taken without harm to the donor plant. You would need to be very brave or foolish to take more than one or two cuttings from *P. emarginata*. Given time, individual plants develop new growth points so eventually a clump of plants is produced. Thus another method of propagation is to carefully divide these clumps.

Conclusion

P. emarginata is so very different from other commonly grown *Pinguicula* that it is a worthwhile addition to any collection, and not particularly difficult to maintain if consideration is given to its slightly unusual growth requirements. Of the *Pinguicula* introduced into cultivation in recent years, *P. emarginata* is a prime candidate for the creation of a new generation of *Pinguicula* hybrids. The many positive attributes of this species (long and prolific flowering period plus distinctiveness) may lead to many beautiful and desirable hybrids which could rekindle greater horticultural enthusiasm in this genus. This was suggested by Slack (1986) when he stated that the horticultural importance of *Pinguicula* could equal African Violets given time—to date this vision remains unfulfilled.

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Red Letter Days of a Pennsylvania Botanist

Phil Sheridan
psher001@odu.edu

Meadowview Biological Research Station
8390 Fredericksburg Tnpk.
Woodford, VA 22580

Old Dominion University
Department of Biological Sciences
Norfolk, VA 23529-0266

Keywords: conservation — history: Tom Darling.

On July 24, 1993 The Nature Conservancy dedicated the 1.6 km^2 (400 acre) Thomas Darling Nature Preserve in Monroe County, Pennsylvania. This was in recognition of Tom Darling's lifelong efforts to preserve natural areas and his support of The Nature Conservancy. Mr. Darling's persistent efforts over ten years also helped result in the preservation of Lehigh Pond, one of the most pristine bog habitats in Pennsylvania. Since its dedication, the Thomas Darling Nature Preserve has been expanded to nine square kilometers (2200 acres) and includes glacial wetlands, peatlands, shrub swamps, acidic fens, marshes, wet meadows, and the state's largest native spruce, tamarack, and balsam forest.

The dedication of the preserve occurred at Bear Lake Lodge two days before Mr. Darling's 90th birthday. I drove up to Bear Lake early that day but was not able to find Mr. Darling at the house since he was walking around North Cove Bog looking at his botanical treasures. Fortunately, I located him and joined him in the survey. Many of Mr. Darling's plant rarities have survived since their introduction over sixty years ago (Sheridan, 1989).

Mr. Darling was the special guest of honor on July 23, 1994 at the Boy Scouts of America 75th Anniversary Celebration at Camp Acahela. He was the first Nature Director at Camp Acahela in 1924 and the first Eagle Scout in the Wyoming Valley in 1919. Mr. Darling says this is where his original enthusiasm for nature and botany began, leading to his numerous publications (Darling, 1957, 1961, 1962, 1964a & b, 1966; Darling and Shetler, 1972; Wagner and Darling, 1957).

Mr. Darling made an important collection of *Sarracenia rubra* Walt. from Georgia early in his career. He collected *S. rubra* when he was stationed at Camp Wheeler in the U.S. Army during World War II. The collection was made in Bibb County, Georgia "near Lakeside (NE of Macon) April 15, 1945" Darling (PENN). Mr. Darling botanized the Lakeside area on March 28, 1945 with Dr. Berkmans—designer of the Royal Gardens of Belgium (perhaps this refers to The National Botanic Gardens of Belgium at Meise—ed)—when the pitcher plants were still in bud, but returned again by himself on April 15. His field notes for the latter date read, "Drive to Winship Lake, very hot weather, clear sky, morning and afternoon off. Canoeing and swimming following formation and ceremony in honor of Roosevelt's funeral; called on Major Barber and wife in Macon, then to Lakeside in late afternoon. Pitcher plants in full bloom." The only other collection of *S. rubra* from this county was "wet thicket, Lakeside (near Macon) July 2, 1932" Wherry (GH).

According to Troup (pers. comm. to T. Darling, 1975) Dr. Harrold of Macon, Georgia (a noted botanist in his own right, the Charles Harrold Preserve between Macon and Savannah being named after him) may have provided Dr. Wherry with locality data on the *S. rubra* station. Mr. Darling was also a friend of Dr. Harrold who personally showed him many interesting botanical finds near Macon, and it is likely that the Lakeside bog was well known to local botanists. Investigations by Troup in 1974, Sheridan and Troup in 1990, and Sheridan in 1992 have all failed to relocate the Lakeside *S. rubra* colony. Examination of topographic maps indicates that this population probably occurred on a pond margin at Lakeside or on a sandhill seep.

The only other pitcher plant species collected in the Macon area was *S. flava* L. by S. M. Tracy (*Drosera filiformis* var. *tracyi* is named after him) on May 5, 1889 (US). Troup and McDaniel (1980) and Troup (pers. comm. 1995) state that Tracy's collection is actually *S. oreophila* (Kearney) Wherry. While the specimen lacks phyllodia which would clarify whether it is *S. flava* or *S. oreophila*, Troup (pers. comm. 1995) points out several important reasons that suggest it is *S. oreophila*. The specimen was found in the same geographic range as other *S. oreophila* populations along the Alabama and Georgia fall line sandhills. The overall size of the specimen is relatively smaller than a typical flowering *S. flava* and the scape is taller than the adult pitcher as is typical of *S. oreophila*. The scapes of *S. flava* are decidedly shorter than the average sized pitchers.

S. rubra also grew with *S. oreophila* in Taylor County, Georgia (Troup and McDaniel, 1980). Mr. Darling's collection of *S. rubra* in the same county as *S. oreophila* is an important one and helps to link these two species geographically. I hope that future work in Bibb County will rediscover *S. rubra* or the more elusive *S. oreophila* with Mr. Darling's work as a helpful foundation.

I congratulate Mr. Darling on his lifelong achievements and wish him many more years to come. Those interested in visiting the Thomas Darling Nature Preserve should contact The Nature Conservancy at (717) 643-7922.

(Conversations with the The Nature Conservancy staff in Pennsylvania revealed that they hope to enlarge the Thomas Darling Nature Preserve in the future. Those interested in supporting The Nature Conservancy's work in Pennsylvania should call the number listed above, or write to The Nature

Conservancy, Poconos Mountain Program, P.O. Box 55, Long Pond, PA 18334—ed)

Acknowledgments

Thanks to Tom Darling, Randy Troup, and Don Schnell for review of the manuscript.

Figure 1: Tom Darling with Bud Cook of The Nature Conservancy. Photo by Sally Fuller.

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News & Views

Robert Cantley (email: borneo@lanka.net) sent us some information about his new *Nepenthes* venture: "Borneo Exotics is a group of enthusiasts who have been growing *Nepenthes* from seed since the early '80s and are dedicated to this particular genus. We are active in conservation, and also plan on starting commercial propagation early next year. We hope that eventually Borneo Exotics may become a major source of *Nepenthes* for the worldwide market. This will enable us to continue our regular expeditions to search for endangered species and attempt to bring them into cultivation from seed. We are searching for new species in relatively unexplored regions of southeast Asia. (Photographs of all the species we have seen in the wild are on our web site at http://www.borneoexotics.com.) We have already constructed nurseries here in Sri Lanka, in the hot lowlands near Colombo and also up in the mountains. Some two million plants of *Nepenthes* are in cultivation, but many of them will take years to mature."

Peter D'Amato (7020 Trenton-Healdsburg Rd., Forestville, CA 95436 USA) shipped us the summer 1998 issue of "California Wild" magazine, which includes a nicely illustrated article he wrote about carnivorous plants. In case you haven't noticed, Peter is riding a wave of public interest since his new book (reviewed in CPN 27:3) was published. He has been featured on numerous television shows, radio programs, and newspaper articles. Those on the internet discussion group have read his occasional postings about hobnobbing with the crew of the Martha Stewart show, etc. What will be next—a movie deal with Spielberg?

Bob Hanrahan (2336 Cross Creek Drive, Powder Springs, GA 30127 USA) who is well known for his nursery (WIP) which was so important for carnivorous plant horticulture during the '70s, sent some sad news about the carnivorous plant bog he owns: "It seems that for the first time in nearly 15 years I had some major plant poaching on my bog....They pretty much destroyed a 13 year old migratory experiment I was doing with *Dionaea muscipula* by taking nearly 500 plants....I was also doing a natural hybridization test and they pulled about 1,000 mature *Sarracenia* plants from it." Bob is going to be putting up new gates and signs, and wanted to mention that "The property is patrolled by the Highway 87 Hunting Club, the US Fish & Wildlife Service, and others."

P. alpina, Switzerland, 2100 m (6800 ft)

Manny Herrara (11945 S.W. 10th Terrace, Miami FL 33184) sent descriptions of his exploits: "I remember reading an article about someone inserting *Nepenthes* cuttings into water. I've experimented by placing *N. mirabilis* cuttings into jars of water. I treated them like normal cuttings, kept them in half shade. I had great success! The cuttings rooted and even pitchered! I wonder if this will work with other *Nepenthes* species?"

"In May of 1997 I took a tour of western and central Europe. The senior class and I spent three days in Zermatt, a small village in southwestern Switzerland. Zermatt

lies at the foot of the Matterhorn, near the Italian border. Apart from skiing and strolling the calm streets of Zermatt, I went hiking up one of the nearer mountains accompanied by another classmate. The scenery was typical of that region of Europe—green hills full of wildflowers, right out of The Sound of Music. About halfway up the side of the mountain that there were small streams running down. Growing in these streams was *P. alpina*. I continued my hike up the mountain until I finally reached snow. About six feet away from the snow were more plants. This species was sparsely populated on the mountain and were growing on rocky soil."

Peggy Olwell (National Park Service, 1849 C Street, N.W., Washington, D.C. 20240): sent the ICPS information about funding opportunities for conservation projects. She sent it because the ICPS (along with approximately 100 other conservation groups) is a formal cooperator organization with the Native Plant Conservation Initiative (NPCI). While the funding deadline for conservation projects has already passed for this year, we may pursue funds next year. The NPCI is an initiative in the United States which focuses on the protection of rare native plants and habitats. To learn more, see their web site at http://www.aqd.nps.gov/npci/.

Randall Palmer (13307A N Ola Avenue, Tampa, FL 33612 USA) sent us information about the Tampa Bay Carnivorous Plant Club. Talk about an active group for something of relatively small size! This club has its own newsletter marvelously named Trappings (about 4 pages long), meetings, raffles, tours of tissue culture facilities, and booths in plant fairs. They even have their own internet domain (http://www.tbcpc.org)! If our own members were as active in the ICPS, not even Microsoft could stand in our way! To learn more about the TBCPC, go to their web site or write P.O. Box 30112, 4202 Fowler Avenue, Tampa, FL 33620 USA.

Barry Meyers-Rice (P.O. Box 72741, Davis, CA 95617 USA) says: "The California bog that has the anthocyanin-free *Darlingtonia californica* 'Othello' has been saved from logging and probable destruction! As reported in the August 3 issue of The Union (Grass Valley, California), the $25,000 raised for this effort came from various conservation funds and private donations. This happened because of work by the California Native Plant Society, the International Carnivorous Plant Society, and many enthusiastic letter-writers. I am continuing to study the plant populations at this location, and have distributed more seed directly to the seed banks of various CP societies. Seed from last year's work germinated well for growers worldwide. While I am afraid some of the seed I collected this year may be contaminated with green × red seeds (instead of pure green × green) most of it should be pure and viable. Check the seed banks of the ICPS or other societies."

Ivan Snyder (110 Meyer Court, Hermosa Beach, CA 90254) sent in a tantalizing preview of his work on hybridizing *Drosera*: "I am not yet ready to write a full article on the subject because there are more experiments I wish to complete first. You may know of some of my successes such as one mentioned by Fernando Rivadavia in CPN a few years ago, the cross of *burmannii* × *sessilifolia*. Another fertile cross found in the seedbank is *dielsiana* × *nidiformis* from Magaliesberg, Transvaal. I have now taken my experimentation a step higher by treating sterile hybrids with the chemical colchicine, long used by plant breeders to double chromosome number and renew fertility. A sterile cross I made of *D. anglica* from Hawaii and *D. spatulata* from Australia I treated with colchicine and now I have second generation

plants. It is an octoploid having 80 chromosomes, the highest number for a sundew. You will see it in the seedbank once I've saved enough seed. There are more new species on the way. You can expect an article from me in 1999. Growers will be delighted to learn that their previously sterile yet beautiful hybrids can be made fertile."

Jan Schlauer writes: "As approved by the ISHS Commission for Nomenclature and Registration and confirmed by the ISHS Council and Executive Committee at their joint meeting on August 1st 1998 in Brussels, the ICPS was appointed as the International Registration Authority (IRA) for Cultivated Carnivorous Plants. The denomination classes in our responsibility are all genera of Byblidaceae, Cephalotaceae, Dioncophyllaceae, Droseraceae, Drosophyllaceae, Lentibulariaceae, Martyniaceae, Nepenthaceae, Roridulaceae, and Sarraceniaceae. In order to be established, names of cultivars, cultivar groups, or chimaeras belonging to the denomination classes above must be registered with the ICPS from now on. We will publish a checklist of registered and accepted cultivar names soon. Authors who wish to register names of cultivated carnivorous plants should submit the following data to the ICPS (information in bold face is mandatory): **Proposed name**; possible synonyms; possible trade-marks, patents, or plant breeders' rights, awards received with name of awarding body and dates; only in transliterations: original spelling (with non-latin characters) of the proposed name; parentage (when known); **name of originator and/or introducer**; date of origin and/or introduction; **name of nominant**; date of nomination; **name of registrant**; either **previous descriptions** as reprints or **a full description** in a modern language using Latin characters and highlighting diagnostic differences to all other cultivated plants with established names in the respective denomination class; **a high quality colour photograph** showing all diagnostic features together with the permission to reproduce it for the purposes of the ICPS; the preferred propagation method; an explanation of the etymology and meaning of the name."

International Carnivorous Plant Society Seedbank

Tom Johnson, Coordinator
P.O. Box 12281
La Crescenta, CA 91224-0981 USA
tom@carnivorousplants.org
http://www.primenet.com/~tjjohns/seed.htm

Darlingtonia californica—Nevada Co., California
D. californica 'Othello'
Dionaea muscipula
Ibicella lutea—5 seeds per packet
Nepenthes ampullaria—Johore, Malaysia
N. gracilis—Johore, Malaysia
N. rafflesiana—Johore, Malaysia
N. × *ventrata*
N. ventricosa
N. ventricosa × *N.?*
N. (× *ventrata*) × (× *ventrata*)
Pinguicula moranensis
P. macroceras—Sheep Pen Creek, Del Norte Co., California
P. vulgaris—Vernar, Slovak
S. flava
S. flava—Ben Hill Co., Georgia
S. flava—New Bern, Craven Co., North Carolina
S. flava—Fitzgerald, Ben Hill Co., Georgia
S. leucophylla
S. minor—Fitzgerald, Ben Hill Co., Georgia
S. oreophila varieties—inquire
S. psittacina—Fitzgerald, Ben Hill Co., Georgia
S. purpurea subsp. *purpurea*
S. minor × *psittacina*—Fitzgerald, Ben Hill Co., Georgia, seeds mixed
S. alata × *leucophylla*
S. flava × *rubra*—green with gold tops
S. leucophylla × *oreophila* selfing
S. oreophila × *purpurea* subsp. *purpurea* selfing
S. oreophila × *rubra* selfing
Drosera aliciae
D. anglica—N. Slovakia
D. anglica—Czech Republic
D. anglica—Plumas Co., California
D. anglica—(California × Hawaii clones)
D. binata
D. bulbosa subsp. *bulbosa*
D. burmannii
D. burmannii—Beerwah, Queensland
D. burmannii—hybrid (?)
D. capensis—green
D. capensis—red
D. capensis—white flower
D. capensis—purple flower
D. capillaris
D. collinsiae
D. communis
D. derbyensis
D. derbyensis × *ordensis*
D. falconeri
D. filiformis var. *filiformis*
D. indica
D. macrantha subsp. *macrantha*
D. nidiformis
D. ordensis
D. rotundifolia—Del Norte Co., California
D. rotundifolia—Nevada Co. California
D. rotundifolia—Plumas Co., California
D. rotundifolia—Mendocino Co., California
D. rotundifolia—Czech Republic
D. sessilifolia
D. spatulata
D. spatulata—hairy sepals, Gympy, Queensland
D. spatulata—pink flower
D. sp.—Magaliesburg
D. dielsiana × sp. Transvaal

A number in parentheses indicates limited numbers of seed packets remaining.

$1 per packet, IRCs accepted. All correspondence and orders within the US must include a self-addressed, stamped envelope. Postage is $.32 for a seedlist, $.43 when ordering seed. All correspondence with the seedbank must be accompanied by a self addressed stamped envelope. All seed contributions are gratefully accepted. Please use bubble wrap to protect the seeds from postal abuse—this will require additional postage for shipping.

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Referees:
The editors of Carnivorous Plant Newsletter and the officers of the International Carnivorous Plant Newsletter thank the following authorities for acting as external referees for the papers requiring anonymous peer review in 1998: Ron Determan, Daniel Joel, Rudolf Schmid-Hollinger, Don Schnell, and others.

Index of Contributors